

WHAT IS CLAIMED IS:

1. A voltage regulator comprising:

a first stage capable of receiving a reference voltage and capable of having a first current flowing through the first stage;

a second stage, coupled to the first stage, capable of having a second current flowing through the second stage; and

a third stage, coupled to the second stage, capable of outputting an output voltage and capable of having a third current flowing through the third stage,

wherein the first, second and third currents are proportional to each other throughout a range of operation of the voltage regulator between substantially zero output current and maximum output current.

2. The regulator of claim 1, wherein the third stage includes a pass transistor, and the second stage includes a first mirror transistor and an input transistor in series with the first mirror transistor, and

wherein a gate of the first mirror transistor is driven by the same voltage as a gate of the pass transistor.

3. The regulator of claim 2, wherein the first stage includes a second mirror transistor, wherein a gate of the second mirror transistor is driven the same voltage as the gate of the pass transistor.

4. The regulator of claim 3, further including a low pass filter between the gate of the second mirror transistor and the gate of the first mirror transistor.

5. The regulator of claim 4, wherein the low pass filter is an RC network.

6. The regulator of claim 4, wherein the first stage includes a first trickle current source in parallel with a current source that is parallel with the first mirror transistor.

7. The regulator of claim 6, further including a second trickle current source supplying a trickle current to the second stage.

8. The regulator of claim 6, further including a first shut off transistor in series with the first mirror transistor and the input transistor of the second stage, a gate of the shut off transistor being driven by an opamp,

wherein the opamp inputs the reference voltage at a first input, and voltage from a resistor divider at a second input.

9. The regulator of claim 8, further including a second shut off transistor in series with the second mirror transistor and the input transistor of the first stage, a gate of the second shut off transistor being driven by an opamp.

10. The regulator of claim 8, further including a current source between the resistor divider and the supply voltage.

11. The regulator of claim 8, further including an NMOS transistor between the first shut off transistor and the input transistor.

12. The regulator of claim 1, wherein a phase margin of the voltage regulator is at least 60 degrees.

13. The regulator of claim 1, further including a feedback stage with a resistor divider between the third stage and the first stage, wherein a feedback voltage from the resistor divider controls an amplification of the first stage.

14. The regulator of claim 1, wherein a drop-out voltage of the regulator is no more than approximately 14 millivolts.

15. A voltage regulator comprising:

a first stage receiving a reference voltage and having a first current flowing through the first stage;

a second stage having a second current flowing through the second stage; and

a third stage outputting an output voltage and having a third current flowing through the third stage,

wherein the first stage drives the second stage as a low input impedance load.

16. The regulator of claim 15, wherein the third stage includes a pass transistor, and the second stage includes a first mirror transistor and an input transistor in series with the first mirror transistor, and

wherein a gate of the first mirror transistor is driven by the same voltage as a gate of the pass transistor.

17. The regulator of claim 16, wherein the first stage includes a second mirror transistor, wherein a gate of the second mirror transistor is driven the same voltage as the gate of the pass transistor.

18. The regulator of claim 17, further including a low pass filter between the gate of the second mirror transistor and the gate of the first mirror transistor.

19. The regulator of claim 18, wherein the low pass filter is an RC network.

20. The regulator of claim 18, wherein the first stage includes a first trickle current source in parallel with a current source that is parallel with the first mirror transistor.

21. The regulator of claim 20, further including a second trickle current source supplying a trickle current to the second stage.

22. The regulator of claim 20, further including a first shut off transistor in series with the first mirror transistor and the input transistor of the second stage, a gate of the shut off transistor being driven by an opamp,

wherein the opamp inputs the reference voltage at a first input, and voltage from a resistor divider at a second input.

23. The regulator of claim 22, further including a second shut off transistor in series with the second mirror transistor and the input transistor of the first stage, a gate of the second shut off transistor being driven by an opamp.

24. The regulator of claim 22, further including a current source between the resistor divider and the supply voltage.

25. The regulator of claim 22, further including an NMOS transistor between the first shut off transistor and the input transistor.

26. The regulator of claim 1, wherein a phase margin of the voltage regulator is at least 60 degrees.

27. The regulator of claim 1, further including a feedback stage with a resistor divider between the third stage and the first stage, wherein a feedback voltage from the resistor divider controls an amplification of the first stage.

28. The regulator of claim 1, wherein a drop-out voltage of the regulator is no more than approximately 14 millivolts.